README Document for

Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System (FLDAS) Products

Prepared by

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Revision History

Revision Date	*Changes*	*Author*
08/05/2015	Initial version based on information from Amy McNally.	Hualan Rui
09/28/2015	Add information for VIC model	Hualan Rui
12/09/2015	Update the Table 1 and Table 2	Hualan Rui
04/12/2016	Add new data products from simulation “C”	Hualan Rui
	Reviewed and revised	Amy McNally

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Introduction

The Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System (FLDAS) is a custom instance of the NASA Land Information System (LIS; http://lis.gsfc.nasa.gov/) that has been adapted to work with domains, data streams, and monitoring and forecast requirements associated with food security assessment in data-sparse, developing country settings. Adopting LIS allows FEWS NET to leverage existing land surface models and generate ensembles of soil moisture, ET and other variables based on multiple meteorological inputs or land surface models. The goal of the FLDAS project is to achieve more effective use of limited available hydroclimatic observations and is designed to be adopted for routine use for FEWS NET decision support.

The FLDAS includes a crop water balance model used operationally by FEWS NET (GeoWRSI: Verdin and Klaver, 2002; Senay and Verdin, 2003), Africa specific daily rainfall from NOAA Climate Prediction Center (RFE2; Xie and Arkin, 1997) and the CHIRPS, a quasi-global rainfall dataset designed for seasonal drought monitoring and trend analysis (Funk et al., 2014). Additional features include a temporal desegregation scheme so that daily rainfall inputs can be used in both energy and water balance calculations, an irrigation module, and global irrigation and crop maps. State-of-the-practice land data assimilation methods are available in LIS, and will be explored in an associated forecasting project.

Basic characteristics of the FLDAS data

FLDAS data are from Noah and VIC Land Surface Models (LSMs), each model has three simulation runs (forced with three different forcing data), and each simulation runs over three different regions. Simulation run "A" is referred to the simulation run forced by the combination of NCEP's Global Data Assimilation System (GDAS) data and NOAA CPC Africa Rainfall Estimation Algorithm v2 (RFE2) data. Simulation run "B" is referred to the simulation run forced by the combination of the Modern Era Retrospective-analysis for Research and Applications (MERRA) and Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS). Simulation run "C" is referred to the simulation forced by the combination of the new version of the MERRA (MERRA-2) and CHIRPS. FLDAS data are grouped by LSM, forcing data type, spatial coverage, and temporal resolution, as listed in Table 1.

Each simulation run "A" was initialized on 1 January 2001 using soil moisture and other state fields from a FLDAS/Noah model climatology for that day of the year. Each simulation run "B" and "C" was initialized on 1 January 1982 using soil moisture and other state fields from a FLDAS/Noah model climatology for that day of the year.

Temporal coverage is Jan 2001 to present for the simulation "A" runs, Jan 1982 to Dec 2015 for the simulation "B" runs, and Jan 1982 to present for the simulation "C" runs.

The current released FLDAS data are monthly data.

Table 1. FLDAS Data Products

Model	Forcing Data	Region	Product Name
Noah	DAS and RFE2 Referred as "A"	Eastern Africa (EA)	FLDAS_NOAH01_A_EA_M
		Southern Africa (SA)	FLDAS_NOAH01_A_SA_M
		Western Africa (WA)	FLDAS_NOAH01_A_WA_M
	MERRA and CHIRPS Referred as "B"	Eastern Africa (EA)	FLDAS_NOAH01_B_EA_M
		Southern Africa (SA)	FLDAS_NOAH01_B_SA_M
		Western Africa (WA)	FLDAS_NOAH01_B_WA_M
	MERRA-2 and CHIRPS Referred as "C"	Eastern Africa (EA)	FLDAS_NOAH01_C_EA_M
		Southern Africa (SA)	FLDAS_NOAH01_C_SA_M
		Western Africa (WA)	FLDAS_NOAH01_C_WA_M
VIC	GDAS and RFE2 Referred as "A"	Eastern Africa (EA)	FLDAS_VIC025_A_EA_M
		Southern Africa (SA)	FLDAS_VIC025_A_SA_M
		Western Africa (WA)	FLDAS_VIC025_A_WA_M
	MERRA and CHIRPS Referred as "B"	Eastern Africa (EA)	FLDAS_VIC025_B_EA_M
		Southern Africa (SA)	FLDAS_VIC025_B_SA_M
		Western Africa (WA)	FLDAS_VIC025_B_WA_M
	MERRA-2 and CHIRPS Referred as "C"	Eastern Africa (EA)	FLDAS_VIC025_C_EA_M
		Southern Africa (SA)	FLDAS_VIC025_C_SA_M
		Western Africa (WA)	FLDAS_VIC025_C_WA_M

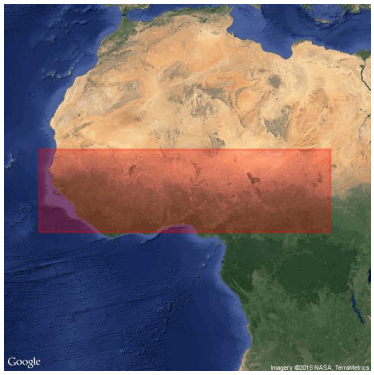
Spatial resolutions are 0.1 x 0.1 degree for FLDAS Noah model data and 0.25 x 0.25 degree for FLDAS VIC model data. The spatial resolutions and coverages are summarized in Table 2.

Table 2. FLDAS Spatial Resolution and Coverage

LSM	Region	Spatial Coverage	Spatial Resolution	Dimension lat x lon
Noah	Eastern Africa	11.8S ~ 23.0N, 22.0E ~ 51.4E	0.1º x 0.1º	348 x 294
Noah	Southern Africa	37.9S ~ 6.4N 6.0E ~ 54.6E	0.1º x 0.1º	443 x 486
Noah	Western Africa	5.3N ~ 17.7N 18.7W ~ 25.9E	0.1º x 0.1º	124 x 446
VIC	Eastern Africa	12.0S ~ 23.25N, 21.75E ~ 51.25E	0.25º x 0.25º	141 x 118
VIC	Southern Africa	34.75S ~ 6.75N, 5.75E ~ 51.25E	0.25º x 0.25º	166 x 182
VIC	Western Africa	5.0N ~ 18.0N 17.25W ~ 25.75E	0.25º x 0.25º	52 x 172

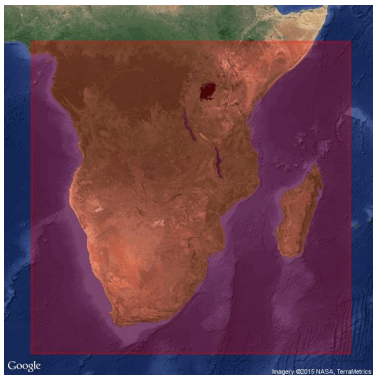
Figure 1. FLDAS spatial Coverage for 0.1°x0.1° data products

Western Africa



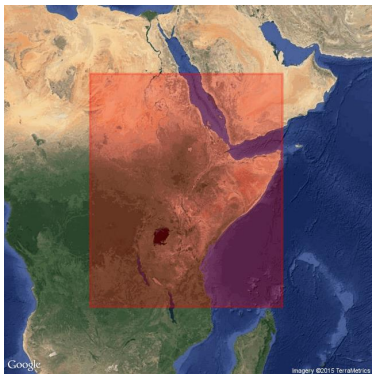
5.3N, 18.7W, 17.7N, 25.9E

Southern Africa



37.9S, 6.0E, 6.4N, 54.6E

Eastern Africa



11.8S, 22.0E, 23.0N, 51.4E

Updates

Please periodically check the GES DISC web site and GES DISC Hydrology Portal for the latest FLDAS data.

Acknowledgment

Please refer to McNally et al. (2015) for more information about the FLDAS project.

NASA requests that you include the following acknowledgment in papers published using these data:

"*The data used in this study were acquired as part of the mission of NASA's Earth Science Division and archived and distributed by the Goddard Earth Sciences (GES) Data and Information Services Center (DISC).*"

We would appreciate receiving a copy of your publication, which can be forwarded to the following address:

GES DISC Help Desk
Code 610.2
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
Phone: 301-614-5224
Fax: 301-614-5268
Email: gsfc-help-disc@lists.nasa.gov

Data Organization

Data product naming convention

FLDAS data are grouped by LSM, spatial resolution, forcing data, spatial coverage, and temporal resolution (Table 1). Each group is referred as a data product and named in accordance with the following convention:

FLDAS_<Model><Grid spacing>_<Forcing type>_<Region><Temporal spacing>

Attribute	Description
<Model>	"NOAH" for the Noah Model
	"VIC" for the Variable Infiltration Capacity Model
<Grid spacing>	"025" for 1/4th degree
	"01" for 0.1 degree
<Forcing Type>	"A" for forced with GDAS and RFE2 data
	"B" for forced MEERA and CHIRPS data
	"C" for forced MEERA-2 and CHIRPS data
<Region>	"EA" for Eastern Africa
	"WA" for Western Africa
	"SA" for Southern Africa
<Temporal spacing>	"3H" for 3-hourly data products
	"M" for monthly datasets

For example, FLDAS_NOAH01_B_EA_M is a product name for FLDAS Noah Land Surface Model L4 monthly 0.1 x 0.1 degree for Eastern Africa, forced by MERRA and CHIRPS data.

Based on the product naming convention, the FLDAS data products currently available at GES DISC are named as in Table 1.

File naming convention

FLDAS data files are named in accordance with the following convention:

<Product ID>_.A<Date>.<Product version>.nc

Attribute	Description
<Product ID>	Data Product Short Name (see Table #)
<Date> *	<YYYYMMDD>.<HHHH> for 3-hourly data products
	<YYYYMM> for monthly data products
<Product version>	"001" for Version 1

* (4-digit year; 2-digit month; 2-digit day of month; 4-digit GMT hour of day)

For examples, "FLDAS_NOAH01_B_EA_M.A198201.001.nc is a file for monthly 0.1 degree FLDAS data from Noah LSM force by MERRA and CHIRPS data for January 1982.

File Format Structure

The FLDAS data are archived in NetCDF format. NetCDF is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data [see more].

Data Contents

Noah Model Data

FLDAS Noah model has three simulation runs ("A", "B", and "C") for Eastern Africa, Southern Africa, and Western Africa. The Noah simulation "A" was initialed on January 1, 2001, forced by soil moisture and other state fields from GDAS and RFE2. The Noah simulation "B" was initialed on January 1, 1982, forced by soil moisture and other state fields from MERRA and CHIRPS. The Noah simulation "C" was initialed on January 1, 1982, forced by soil moisture and other state fields from MERRA-2 and CHIRPS. FLDAS Noah model data contain twenty-five fields, as listed in Table 3a.

VIC Model Data

FLDAS VIC model has three simulation runs ("A", "B", and "C") for Eastern Africa, Southern Africa, and Western Africa. The VIC simulation "A" was initialed on January 1, 2001, forced by soil moisture and other state fields from GDAS and RFE2. The VIC simulation "B" was initialed on January 1, 1982, forced by soil moisture and other state fields from MERRA and CHIRPS. The VIC simulation "C" was initialed on January 1, 1982, forced by soil moisture and other state fields from MERRA-2 and CHIRPS. FLDAS VIC model data contain twenty-three fields, as listed in Table 3b.

Table 3a. Parameters (total 25) from FLDAS Noah model data

Short Name	Description	Unit
Evap_tavg	Evapotranspiration	kg m-2 s-1
LWdown_f_tavg	Downward long-wave radiation flux	W m-2
Lwnet_tavg	Net long-wave radiation flux	W m-2
Psurf_f_tavg	Surface pressure	Pa
Qair_f_tavg	Specific humidity	Kg kg-1
Qg_tavg	Heat flux	W m-2
Qh_tavg	Sensible heat net flux	W m-2
Qle_tavg	Latent heat net flux	W m-2

Qs_tavg	Storm surface runoff	kg m-2 s-1
Qsb_tavg	Baseflow-groundwater runoff	kg m-2 s-1
RadT_tavg	Surface radiative temperature	K
Rain_f_tavg	Total precipitation rate	kg m-2 s-1
SM01_Percentile	Soil moisture percentiles	%
SoilMoi00_10cm_tavg	Soil moisture (0 - 10 cm underground)	m^3 m-3
SoilMoi10_40cm_tavg	Soil moisture (10 - 40 cm underground)	m^3 m-3
SoilMoi100_200cm_tavg	Soil moisture (100 - 200 cm underground)	m^3 m-3
SoilMoi40_100cm_tavg	Soil moisture (40 - 100 cm underground)	m^3 m-3
SoilTMP00_10cm_tavg	Soil temperature (0 - 10 cm underground)	K
SoilTMP10_40cm_tavg	Soil temperature (10 - 40 cm underground)	K
SoilTMP100_200cm_tavg	Soil temperature (100 - 200 cm underground)	K
SoilTMP40_100cm_tavg	Soil temperature (40 - 100 cm underground)	K
SWdown_f_tavg	Surface downward shortwave radiation	W m-2
Swnet_tavg	Net short wave radiation flux	W m-2
Tair_f_tavg	Near surface air temperature	K
Wind_f_tavg	Near surface wind speed	m s-1

The short names with extension "_tavg" are past 3-hr averaged variables.
The short names with "_f" are forcing variables.

Table 2b. Parameters (total 23) from FLDAS VIC model data

Short Name	**Description**	**Unit**
Evap_tavg	Evapotranspiration	kg m-2 s-1
LWdown_f_tavg	Downward long-wave radiation flux	W m-2
Lwnet_tavg	Net long-wave radiation flux	W m-2
Psurf_f_tavg	Surface pressure	Pa
Qair_f_tavg	Specific humidity	Kg kg-1
Qg_tavg	Heat flux	W m-2
Qh_tavg	Sensible heat net flux	W m-2
Qle_tavg	Latent heat net flux	W m-2
Qs_tavg	Storm surface runoff	kg m-2 s-1
Qsb_tavg	Baseflow-groundwater runoff	kg m-2 s-1
RadT_tavg	Surface radiative temperature	K
Rain_f_tavg	Total precipitation rate	kg m-2 s-1
SM01_Percentile	Soil moisture percentiles	%
SoilMoi00_10cm_tavg	Soil moisture (0 - 10 cm underground)	m^3 m-3
SoilMoi10_160cm_tavg	Soil moisture (10 - 160 cm underground)	m^3 m-3
SoilMoi160_190cm_tavg	Soil moisture (160 - 190 cm underground)	m^3 m-3

SoilTMP00_10cm_tavg	Soil temperature (0 - 10 cm underground)	K
SoilTMP10_160cm_tavg	Soil temperature (10 - 160 cm underground)	K
SoilTMP160_190cm_tavg	Soil temperature (160 - 190 cm underground)	K
SWdown_f_tavg	Surface downward shortwave radiation	W m-2
Swnet_tavg	Net short wave radiation flux	W m-2
Tair_f_tavg	Near surface air temperature	K
Wind_f_tavg	Near surface wind speed	m s-1

The short names with extension "_tavg" are past 3-hr averaged variables.
The short names with "_f" are forcing variables.

Soil moisture percentiles are an indicator of growing season conditions in the context of historical observations. More information about the soil moisture percentiles can be found at http://lis.gsfc.nasa.gov/sites/default/files/LIS/docs/SoilMoisturePercentile.pdf.

Reading the Data

The FLDAS data are archived in self-describing and machine-independent NetCDF format. The Unidata page, http://www.unidata.ucar.edu/software/netcdf/software.html, provides a list of software for manipulating or displaying NetCDF Data.

Reading/viewing the data by Panoply

Panoply, http://www.giss.nasa.gov/tools/panoply/, is a cross-platform application that plots geo-referenced and other arrays from NetCDF, HDF, GRIB, and other data sets.

The Data Cookbook of NASA GES DISC provides a recipe for Quick View Data with Panoply.

Reading/viewing the data by GrADS

The Grid Analysis and Display System (GrADS) is an interactive desktop tool for easy access, manipulation, and visualization of earth science data. GrADS supports several data formats, such as binary, NetCDF, HDF, and GRIB. The documentation and software for GrADS can be found at: http://cola.gmu.edu/grads/.

Each individual FLDAS NetCDF file can be opened by GrADS sdfopen directly without a data descriptor file (aka ctl file). After calling sdfopen, GrADS commands, such as "q file", "d [variable_name]", etc. can be used to query file information, read and display the data. Below is an example showing how to sdfopen a FLDAS NetCDF file and query for the dimensions and variables of the file.

```
hrui@hydro1:~/FLDAS_1.0$ grads

               Welcome to the OpenGrADS Bundle Distribution
               -------------------------------------------
```

```
For additional information enter "grads -h".

Starting "/opt/grads-
2.1.a2.oga.1/Linux/Versions/2.1.a2.oga.1/x86_64/grads   " ...


Grid Analysis and Display System (GrADS) Version 2.1.a2.oga.1
Copyright (c) 1988-2013 by the Institute for Global Environment and
Society (IGES)
GrADS comes with ABSOLUTELY NO WARRANTY
See file COPYRIGHT for more information

Config: v2.1.a2.oga.1 little-endian readline grib2 netcdf hdf4-sds
hdf5 opendap-grids,stn athena geotiff shapefile cairo
Issue 'q config' command for more detailed configuration information
Loading User Defined Extensions table </opt/grads-
2.1.a2.oga.1/Linux/Versions/2.1.a2.oga.1/x86_64/gex/udxt> ... ok.
Landscape mode? ('n' for portrait):
GX Package Initialization: Size = 11 8.5
ga-> sdfopen FLDAS_NOAH01_B_SA_M.A198201.001.nc
Scanning self-describing file:  FLDAS_NOAH01_B_SA_M.A198102.001.nc
SDF file FLDAS_NOAH01_B_SA_M.A198201.001.nc is open as file 1
LON set to 6.05 54.55
LAT set to -37.85 6.35
LEV set to 0 0
Time values set: 1982:1:1:0 1982:1:1:0
E set to 1 1
ga-> q file
File 1 : LVT land surface analysis output
  Descriptor: FLDAS_NOAH01_B_SA_M.A198201.001.nc
  Binary: FLDAS_NOAH01_B_SA_M.A198201.001.nc
  Type = Gridded
  Xsize = 486  Ysize = 443  Zsize = 1  Tsize = 1  Esize = 1
  Number of Variables = 25
     evap_tavg  0  t,y,x  total evapotranspiration
     lwdown_f_inst  0  t,y,x  surface downward longwave radiation
     lwnet_tavg  0  t,y,x  net downward longwave radiation
     psurf_f_inst  0  t,y,x  surface pressure
     qair_f_inst  0  t,y,x  specific humidity
     qg_tavg  0  t,y,x  soil heat flux
     qh_tavg  0  t,y,x  sensible heat flux
     qle_tavg  0  t,y,x  latent heat flux
     qs_tavg  0  t,y,x  surface runoff
     qsb_tavg  0  t,y,x  subsurface runoff amount
     rainf_f_inst  0  t,y,x  rainfall flux
     rainf_tavg  0  t,y,x  total precipitation
     sm01_percentile  0  t,y,x  soil moisture content
     swdown_f_tavg  0  t,y,x  surface downward shortwave radiation
     soilmoi00_10cm_  0  t,y,x  soil moisture content
     soilmoi10_40cm_  0  t,y,x  soil moisture content
     soilmoi40_100cm  0  t,y,x  soil moisture content
     soilmoi100_200c  0  t,y,x  soil moisture content
     soiltemp00_10cm  0  t,y,x  soil temperature
     soiltemp10_40cm  0  t,y,x  soil temperature
     soiltemp40_100c  0  t,y,x  soil temperature
     soiltemp100_200  0  t,y,x  soil temperature
```

```
     swnet_tavg  0  t,y,x  net downward shortwave radiation
     tair_f_inst  0  t,y,x  air temperature
     wind_f_inst  0  t,y,x  wind speed
ga->
```

With a GrADS descriptor file, by using GrADS command xdfopen, multiple FLDAS NetCDF files can be opened, therefore, time aggregation related visualization and data analysis can be done by GrADS. Below is a GrADS sample descriptor file for monthly 0.1x0.1 degree Noah model data product FLDAS_NOAH01_B_SA_M.001.

FLDAS_NOAH01_M.001.xdf, a sample data descriptor file

```
DSET FLDAS_NOAH01_B_SA_M.A%y4%m2.001.nc
OPTIONS template
TDEF time   411  LINEAR       Jan1982  1mo
*** variable name may not appear completely (max 15 characters)
```

An example for using xdfopen to open **FLDAS_NOAH01_B_SA_M.001.XDF**

```
ga-> xdfopen FLDAS_NOAH01_B_SA_M.001.XDF
Scanning Descriptor File:  FLDAS_NOAH01_B_SA_M.001.XDF
SDF file /var/tmp/hrui/FLDAS/FLDAS_NOAH01_B_SA_M.A%y4%m2.001.nc is
open as file 1
LON set to 6.05 54.55
LAT set to -37.85 6.35
LEV set to 0 0
Time values set: 1982:1:1:0 1982:1:1:0
E set to 1 1
ga-> q file
File 1 : LIS land surface model output
  Descriptor: FLDAS_NOAH01_B_SA_M.001.XDF
  Binary: /var/tmp/hrui/FLDAS/FLDAS_NOAH01_B_SA_M.A%y4%m2.001.nc
  Type = Gridded
  Xsize = 486  Ysize = 443  Zsize = 1  Tsize = 411  Esize = 1
  Number of Variables = 25
     evap_tavg  0  t,y,x  total evapotranspiration
     lwdown_f_tavg  0  t,y,x  surface downward longwave radiation
     lwnet_tavg  0  t,y,x  net downward longwave radiation
     psurf_f_tavg  0  t,y,x  surface pressure
     qair_f_tavg  0  t,y,x  specific humidity
     qg_tavg  0  t,y,x  soil heat flux
     qh_tavg  0  t,y,x  sensible heat flux
     qle_tavg  0  t,y,x  latent heat flux
     qs_tavg  0  t,y,x  surface runoff
     qsb_tavg  0  t,y,x  subsurface runoff amount
     radt_tavg  0  t,y,x  surface radiative temperature
     rainf_f_tavg  0  t,y,x  rainfall flux
     sm01_percentile  0  t,y,x  soil moisture percentiles
     swdown_f_tavg  0  t,y,x  surface downward shortwave radiation
     soilmoi00_10cm_  0  t,y,x  soil moisture content
     soilmoi10_40cm_  0  t,y,x  soil moisture content
     soilmoi40_100cm  0  t,y,x  soil moisture content
```

```
     soilmoi100_200c  0  t,y,x  soil moisture content
     soiltemp00_10cm  0  t,y,x  soil temperature
     soiltemp10_40cm  0  t,y,x  soil temperature
     soiltemp40_100c  0  t,y,x  soil temperature
     soiltemp100_200  0  t,y,x  soil temperature
     swnet_tavg  0  t,y,x  net downward shortwave radiation
     tair_f_tavg  0  t,y,x  air temperature
     wind_f_tavg  0  t,y,x  wind speed
ga->
```

Data Access

The NASA GES DISC maintains archives of all FLDAS data products and many other Hydrology data sets. The archived data can be accessed via HTTP network transfer. FLDAS data can be accessed via the GES DISC Unified User Interface (UUI) at http://disc.sci.gsfc.nasa.gov/uui/#/search/FLDAS.

Data Volume

Model	Resolution	Spatial Coverage	File Size	Volume/year	
				Monthly Data	
Noah	0.1° ×0.1°	Eastern Africa	11.0 MB	132 MB	
		Southern Africa	22.5 MB	270 MB	
		Western Africa	5.8 MB	70 MB	
VIC	0.25° ×0.25°	Eastern Africa	1.6 MB	19 MB	
		Southern Africa	2.8 MB	33 MB	
		Western Africa	0.9 MB	10 MB	

The table will be updated as data volume information for other models become available.

Search and download data via Mirador

FLDAS data can be searched through a keyword (e.g., Noah) and the time span, and downloaded in a batch mode via Mirador, http://mirador.gsfc.nasa.gov/cgi-bin/mirador/collectionlist.pl?keyword=FLDAS.

OPeNDAP Access

The FLDAS data can be accessed via OPeNDAP:
http://hydro1.gesdisc.eosdis.nasa.gov/opendap/hyrax/FLDAS/.

HTTP Access

The FLDAS data can be downloaded directly via the GES DISC HTTP server: http://hydro1.gesdisc.eosdis.nasa.gov/data/s4pa/FLDAS/.

Points of Contact

For information about or assistance in using any GES DISC data, please contact the GES DISC Help Desk at:

GES DISC
Code 610.2
NASA Goddard Space Flight Center
Greenbelt, Maryland 20771
Email: gsfc-help-disc@lists.nasa.gov
301-614-5224 (voice)
301-614-5268 (fax)

For general science questions and comments, please contact:

Amy McNally.
Earth System Science Interdisciplinary Center
University of Maryland, College Park
Hydrological Sciences Laboratory, Code 617
NASA Goddard Space Flight Center
Greenbelt, MD 20771
Email: Amy.l.Mcnally@nasa.gov
Phone: 301-614-6723

Sponsor and Acknowledgment

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DOIs for FLDAS Version 001 Data Products

A Digital Object Identifier or DOI is a unique alphanumeric string used to identify a digital object and provide a permanent link online. DOIs are often used in online publications in citations. The table 3 list DOIs for FLDAS data products.

Table 3. DOIs for FLDAS Version 001 Data Products
DOIs for FLDAS data products are in application process now and will be listed in Table 3 after the application process is completed.

Each of DOIs in the Table 3 is linked to the corresponding data product page and Data Citation for the data product is on top of the page. If you use these data in your research or applications please include a reference in your publication(s) similar to the following example:

Amy McNally, NASA/GSFC/HSL (10.01.2015), *FLDAS Noah Land Surface Model L4 monthly 0.1 x 0.1 degree for Southern Africa (MERRA and CHIRPS), Version 001*, Greenbelt, Maryland, USA: Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed **Enter User Data Access Date** at doi:10.5067/XXXXXXXXXX

References

McNally, Amy and others, The Famine Early Warning Land Data Assimilation System, in prep from Bull. Amer. Meteor. Soc., 2015.

Appendices

A. Description of Metadata

Table A.1. Collection level metadata

Metadata items
C1. Collection data description
1. ShortName
2. LongName
3. TemporalRange
4. SpatialCoverage
5. DataResolution
6. Format (e.g., GRIB1)
7. LandSurfaceModel
LandSurfaceModelVersionID
C2. ScienceParameter group (Parameters listed in Table 2)

Table A.2. Granule level metadata

Metadata items
G1. General description
1. GranuleID
2. GranuleDate
3. LatitudeResolution
4. LongitudeResolution
5. Format (e.g., GRIB1)
6. SizeBytesDataGranule
7. LandSurfaceModel
G2. Grib data description
1. SouthernmostLatitude
2. NorthernmostLatitude
3. WesternmostLongitude
4. EasternmostLongitude
5. BeginningDateTime
6. EndingDateTime
G3. ScienceParameter Group
1. ParameterShortName
2. ParameterLongName

3. Center
4. Subcenter
5. Process
6. Level (or Layer)
7. Height (or Pressure)
8. TimeRange
9.PeriodTime1
10. PeriodTime2
11. ForecastTimeUnit
12. GridSize
13. ForecastAnalysisFlag
14. NumberGridsAverage
15. MinValueData
16. MaxValueData
G4. Ingest information
1.ProductionDateTime
2.InsertDateTime

B. Acronyms

The following acronyms and abbreviations are used in this document.

CHIRPS	Climate Hazards Group InfraRed Precipitation with Station data
FLDAS	Famine Early Warning Systems Network (FEWS NET) Land Data Assimilation System
GDAS	Global Data Assimilation System
GDS	GrADS Data Server
GES DISC	Goddard Earth Sciences Data and Information Services Center
Giovanni	GES-DISC Interactive On-line Visualization and Analysis Infrastructure
GrADS	Grid Analysis and Display System
GRIB	GRIdded Binary
HDF	Hierarchical Data Format
HDISC	Hydrology Data and Information Services Center
LDAS	Land Data Assimilation System
LIS	Land Information System
LSM	Land Surface Model
MERRA	Modern Era Retrospective-analysis for Research and Applications
MERRA-2	MERRA Version 2
Mirador	Fast interface for searching Earth science data at NASA GES DISC
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
netCDF	network Common Data Form
NIDIS	National Drought Integrated Information System
Noah	National Centers for Environmental Prediction/Oregon State University/ Air Force/Hydrologic Research Lab (Noah)
VIC	Variable Infiltration Capacity macroscale model